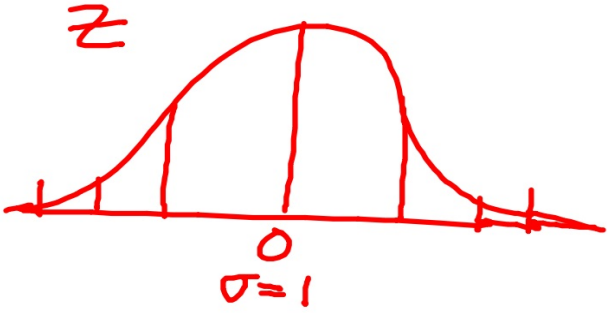
10.1 notes: Chi-Square Goodness-of-Fit test

Testing prop.

$$z = \frac{\hat{p} - p}{\sqrt{\frac{p(1-p)}{n}}}$$

Normal

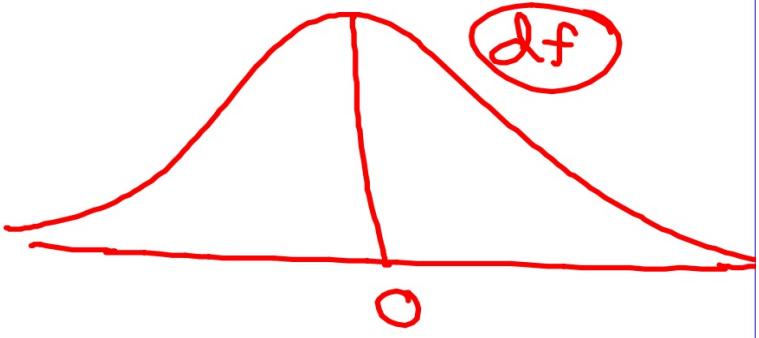
z



Testing mean

$$t = \frac{\bar{x} - \mu}{s/\sqrt{n}}$$

t-distribution



	1	2	3	4	5	6
exp	10	10	10	10	10	10
obs	12	7	3	20		

Chi-Square Goodness of Fit

χ

- Testing whether an observed distribution (sample) fits expected distrib. (pop)

Hypothesis

$H_0: p = 0.15$

$\mu = 62$

$H_a: p > 0.15$

$\mu \leq 62$ (≠)

H_0: the observed distribution (=) fits the expected distrib. of _____ (context) _____.

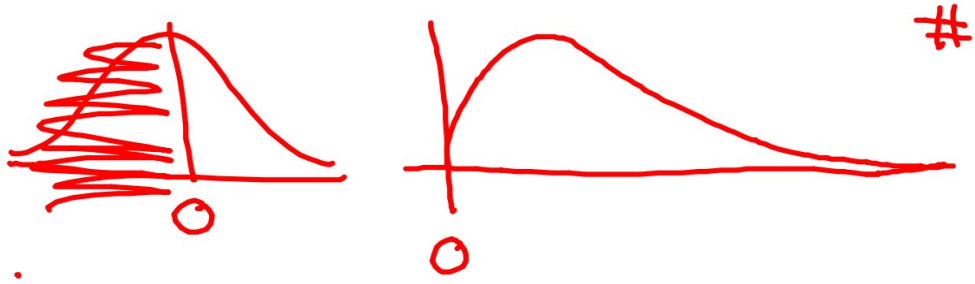
H_a: the obs. distrib doesn't fit the expected distrib. of _____. (≠)

χ^2 Chi-Square

$$\chi^2 = \sum \frac{(\text{observed} - \text{expected})^2}{\text{expected}}$$

sum

χ^2 distribution:

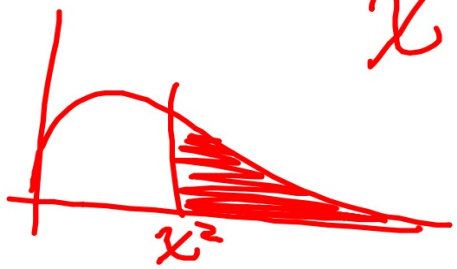


df = # categories − 1

p-value:

$P(\chi^2 > \text{test stat}) =$

$\chi^2\text{cdf}(\text{test stat}, \text{E}99, df)$



Conclusion:

- We reject/fail to reject Ho
- ...
- Suff evid that....
  (re-copy Ho/Ha)

Conditions:

- SRS
- all expected values ≥ 5 . all exp ≠ s

check

	Expected	Obs	
		23	4.267
1	15	50	0.556
2	45		
3	30	42	4.8
4	45	65	8.889
5	15	20	1.67
6	150	100	16.667
	300	300	36.844 = χ^2

Hyp:

H_0: the obs. distrib. of dice rolls fits expected distrib. (=)

H_a: the obs. distrib. of dice rolls doesn't fit the exp. distrib. (≠)

df = 5

$$\chi^2 = \sum \frac{(obs - exp)^2}{exp} = 36.844$$

$$P(\chi^2 > 36.844) = 6.437 \times 10^{-7}$$

- We reject Ho b/c p-value $< \alpha = 0.05$
- We have suff. evid. that....
  (re-copy Ha)

Ex.2

	Observed	Expected
B	102	$(0.69 \times 150) = 103.5$
G	32	$(0.21 \times 150) = 31.5$
E	12	10.5
H	4	4.5
	150	150

Conditions

1) SRS

2) exp. values ≥ 5

1) assume

2)

Ho: the obs. distrib. of laptops fits expected distrib.

Ha: the obs. distrib. of laptops doesn't fit exp. distrib.

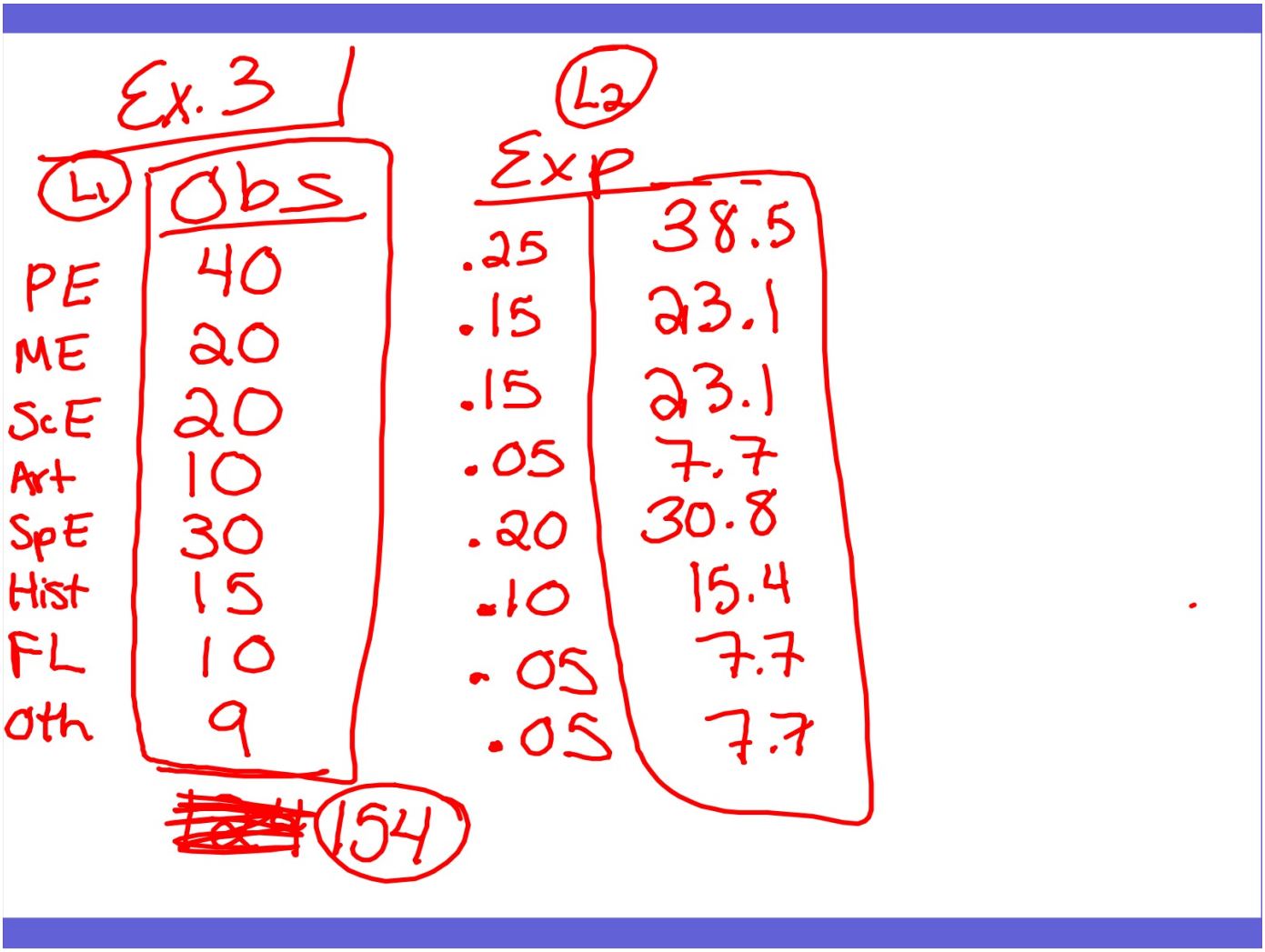
$$\chi^2 = \sum \frac{(obs - exp)^2}{exp} = 0.2995$$

$P(\chi^2 > 0.2995) = 0.9601$

$df = 3$

$\alpha = 0.05$

- We fail to reject H_0 b/c p-value $> \alpha = 0.05$
- We have suff. evid. that... (re-copy H_0)


Ex. 3
L1
Obs
PE 40
ME 20
ScE 20
Art 10
SpE 30
Hist 15
FL 10
oth 9
154
L2
Exp
.25 38.5
.15 23.1
.15 23.1
.05 7.7
.20 30.8
.10 15.4
.05 7.7
.05 7.7

Conditions

1) SRS
2) all exp. ≥ 5

1) stated
2) all ≥ 5 (in chart)

H_0: the obs. distrib. of education majors fits the expected.

H_a: the obs. distrib. of ed. majors doesn't fit the expected.

$$\chi^2 = \sum \frac{(obs-exp)^2}{exp} = 2.515$$

$P(\chi^2 > 2.515) = 0.926$

$df = 7$

- We fail to reject H_0 b/c p-value $> \alpha = 0.05$.
- We have suff. evid. that.... (re-copy H_0).

#3 (L.)

	Obs	Expected
0	11	10
1	8	10
2	7	10
3	7	10
4	10	10
5	10	10
6	8	10
7	11	10
8	14	10
9	14	10

n=100

* uniformly = evenly

$\frac{n}{\text{outcomes}}$

Ho: Observed distrib. of #'s generated fits the exp. distrib.

Ha: " " " " " doesn't fit " " "

$$\chi^2 = \sum \frac{(obs - exp)^2}{exp} = 6$$

$P(\chi^2 > 6) = 0.7399$ (df = 9)

- fail to reject ....
- re-copy Ho

HW: p. 479 #8